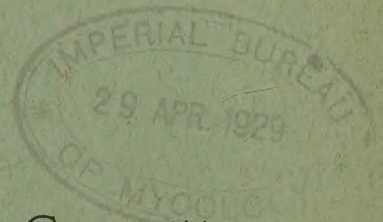


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Rubber Research Scheme

(Ceylon.)

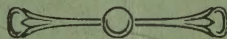


Seventh Report of the Executive Committee

— TO THE —

Members of the Rubber Research Scheme.

PROCEEDINGS DURING THE YEAR
1928.



To be presented at the Ordinary General Meeting

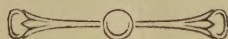
April 19th. 1929.

Rubber Research Scheme

(Ceylon.)

Seventh Report of the Executive Committee
— TO THE —
Members of the Rubber Research Scheme.

PROCEEDINGS DURING THE YEAR
1928.



To be presented at the Ordinary General Meeting

April 19th. 1929.

Rubber Research Scheme (Ceylon).

*Peradeniya,
March 19th, 1929.*

NOTICE.

Notice is hereby given that the Seventh Ordinary General Meeting of the Rubber Research Scheme (Ceylon) will be held at the Chamber of Commerce Rooms, Colombo, on the 19th, of April, 1929, at 11 a.m. for the following purposes:—

1. To receive and consider the Report of the Executive Committee for the year ended December 31st. 1928, and the Annual Statement of Accounts and Balance Sheet as at December 31st, 1928.
2. To receive and consider Reports by the Technical Officers of the Rubber Research Scheme.
3. To receive and consider Report of the London Advisory Committee.
4. To elect Auditors for the coming year and fix their remuneration.
5. To Transact any other business that may arise.

By order,

J. MITCHELL,

Organising Secretary.

Committees of the Rubber Research Scheme

as at December 31st, 1928.

EXECUTIVE COMMITTEE:

Dr. W. SMALL, M.B.E., M.A., B.Sc., Ph.D., F.L.S., (Acting Chairman.)	Mr. W. COOMBE.
Mr. C. W. BICKMORE.	" ALLEN COOMBE.
THE HON'BLE MR. GEO. BROWN.	" J. FARLEY ELFORD.
Mr. A. D. CALLANDER.	" Mr. CLIFFORD FIGG.
" D. S. CAMERON.	" G. B. FOOTE.
" D. DAVIDSON.	" G. P. MADDEN.
" C. E. A. DIAS.	LT.-COL. T. Y. WRIGHT.
	Mr. J. MITCHELL, (Secretary).

TECHNICAL COMMITTEE:

Dr. W. SMALL, Acting Director, of Agriculture, (Acting Chairman.)	THE HON'BLE MR. J. W. OLDFIELD.
" J. C. HUTSON, Entomologist, Department of Agriculture.	Mr. T. E. H. O'Brien, Chemist of Scheme.
Mr. A. W. R. JOACHIM, Chemist, Department of Agriculture.	" R. A. TAYLOR, Physiological Botanist of Scheme.
Mr. M. PARK, Acting Mycologist Dept. of Agriculture.	" R. K. S. MURRAY, Mycologist of Scheme.
	" J. MITCHELL, Organising Secretary of Scheme. (Secretary).

LONDON ADVISORY COMMITTEE:

Representatives of Rubber Growers' Association ...	{ Mr. P. J. BURGESS, M.A., F.C.S. (Chairman)*
	{ Mr. H. ERIC MILLER.
	{ Mr. HERBERT WRIGHT.*
Representatives of Ceylon Planting Interests ...	{ Sir. EDWARD ROSLING.*
	{ Sir. STANLEY BOIS.
	{ Mr. G. H. MASEFIELD.
Representatives of Rubber Manufacturing Companies ...	{ Mr. W. C. SMITH.*
	{ Mr. W. A. WILLIAMS.*
	{ Dr. D. F. TWISS, F.I.C., F.I.R.I.*
Representative of the Research Association of British Rubber and Tyre Manufacturers ...	LT.-COL. J. SEALY CLARKE.*
Representatives of Imperial Institute ...	{ LT.-GEN. SIR WILLIAM FURSE.* K.C.B., D.S.O.
	{ LT.-COL. SIR DAVID PRAIN.* C.M.G., C.I.E., F.R.S.
Botanists...	{ Sir. J. B. FARMER, D.Sc., L.L.D., F.R.S.*
Secretary ...	{ Mr. H. N. RIDLEY, C.M.G., F.R.S.*
	Mr. J. A. NELSON, B.Sc.*

*Members of Technical Sub-Committee.

Auditors:

DUNCUM, WATKINS, FORD, & Co.,
COLOMBO.

Offices:

... RUBBER RESEARCH SCHEME, PERADENIYA.

Bankers:

NATIONAL BANK OF INDIA, LTD.

Research Laboratories:

... CULLODEN ESTATE, NEBODA,

Scientific Staff:

CEYLON.

Mr. J. MITCHELL, A.R.C.Sc., Organising Secretary.	Mr. R. A. TAYLOR, B.Sc., Physiological Botanist.
Mr. T. E. H. O'BRIEN, M.Sc., A.I.C., Chemist.	Mr. R. K. S. MURRAY, A.R.C.Sc., Mycologist.

LONDON.

Mr. G. MARTIN, B.Sc., A.I.C., F.I.R.I. Chemist, (Superintendent).	Mr. F. L. ELLIOTT, F.I.C., F.I.R.I., Chemist.
Mr. W. S. DAVEY, B.Sc., A.I.C., F.I.R.I., Chemist.	Mr. L. L. STEWART, Laboratory Assistant.

EXECUTIVE COMMITTEE'S REPORT TO MEMBERS.

GENTLEMEN,

The Executive Committee of the Rubber Research Scheme (Ceylon) submits its report for the year ended December 31st, 1928.

Membership.—A complete list of members is given in Appendix 1 of this Report from which it will be noted that at December 31st, 1928 there were 103 Rubber Growers' Association members and 119 Rubber Research Scheme members making a total of 222 members in all. At December 31st, 1927 there were 103 Rubber Growers' Association members and 111 Rubber Research Scheme members.

Subscriptions.—The subscriptions from local subscribers on account of the year ended December 31st, 1928 amounted to Rs. 34,527/53 as compared with Rs. 33,610/37 on account of 1927.

The Ceylon Government grant for 1928 was Rs. 67,500/- which is the same as for 1927. The Rubber Growers' Association paid into the London account £2,000 which is the same as for 1927.

Executive Committee.—The Chairman (Mr. F. A. Stockdale) and Mr. F. H. Layard resigned on their departure from Ceylon to take up permanent residence in England. The Acting Director of Agriculture (Dr. W. Small) was appointed to act as Chairman pending the arrival of a successor to Mr. Stockdale.

Meetings of this Committee were held on January 20th, April 27th, July 20th, October 19th, and December 21st, 1928, and copies of the printed minutes of these meetings have been circulated to all members of the Rubber Research Scheme.

London Advisory Committee.—No changes have taken place in the personnel of this Committee during the year. Meetings were held on January 27th, March 30th, June 1st, July 27th, and October 26th, 1928, and copies of the minutes of these meetings have been supplied to all members of the Executive Committee.

The reports of the London Advisory Committee and of the technical officers working at the Imperial Institute, London, are attached.

Technical Committee (Ceylon).—The Chairman (Mr. F. A. Stockdale) resigned on leaving Ceylon to take up permanent residence in England, and the Acting Director of Agriculture (Dr. W. Small) was appointed Acting Chairman pending the arrival of Mr. Stockdale's successor. Mr. H. W. Roy Bertrand resigned, and the Hon'ble Mr. J. W. Oldfield was appointed to fill the vacancy.

Meetings of this Committee were held on February 6th, April 27th, July 20th, and October 12th, 1928, and copies of the minutes of these meetings have been circulated to members of all Committees of the Scheme.

Technical Officers.—Mr. R. A. Taylor (Physiological Botanist) returned from leave on April 2nd, 1928 and resumed duty at the Research Laboratories and as officer in charge of the Experiment Station, Nivitigalakele.

Accounts.—The audited statement of accounts and balance sheet for the year 1928 is given in Appendix 4 of this report.

A liberal amount has been written off for depreciation of buildings, apparatus, and furniture.

It will be noted that the excess of income over expenditure amounts to ~~Rs. 15,393/84~~ ^{Rs 15,699-58} as compared with Rs. 27,386/69 for 1927.

The balance sheet shows cash on fixed deposits, current account, in hand, and in London amounting to Rs. 65,516/71 as compared with Rs. 131,504/57 at the end of 1927. From this balance the sum of Rs. 3,435/69 is earmarked for sundry creditors as compared with Rs. 55,626/18 at the end of 1927 leaving a net balance in the General Fund of Rs. 62,081/02 to be carried forward to 1929 as compared with Rs. 75,878/39 brought in.

During the year a further sum of Rs. 17,402/22 has been spent on the Experiment Station, Nivitigalakele, the development account for which now stands at Rs. 46,899/99.

Laboratories.—The extension to the chemical laboratory has been completed and the accommodation for the research staff and subordinate officers is now much improved. The building has been kept in good repair and the equipment has been kept up to the full requirements of the staff.

Bungalows.—The bungalows for the staff officers have been kept in good repair and improvements to the Mycologist's bungalow have been made. Two bungalows for members of the subordinate staff have been erected on Culloden Estate so that the whole of the staff at the laboratories is now satisfactorily housed within easy distance of the laboratories.

Water Supplies.—The water supplies to the bungalows have been overhauled and are in satisfactory working order.

Rubber Experiment Station.—The whole of the 63 acres have now been opened up on the contour platform terracing system and a comprehensive programme of experiments in connection with the budding of rubber and the proving of mother trees and experiments with numerous varieties of cover crops is being carried out. Many unforeseen difficulties have been encountered during the development of this station, but it is anticipated that much information of value to the rubber industry of Ceylon will be gained from the solving of the problems which have been presented. The following Sub-Committee of the Executive Committee has been appointed to visit the station from time to time to advise the officer in charge and to report thereon:—Messrs. G. B. Foote, J. Farley Elford, D. Davidson, E. C. Villiers, C. E. A. Dias, Lt. Col. T. Y. Wright, and the Chairman of the Executive Committee. Members of this Committee visited the station on August 9th, 1928 and recommendations made by them have been put into effect. Full details of the budding work are given in the Physiological Botanist's report to which the attention of members is directed.

Visitors.—During the year, the Rt. Hon'ble W. Ormsby Gore M. P. (Under Secretary of State for the Colonies), Dr. A. W. Hill (Director, Royal Botanic Gardens, Kew) Major B. J. Eaton (Chief Chemist, Rubber Research Institute of Malaya) and Sir Edward Rosling visited the laboratories and discussed rubber research work with the technical officers. In addition numerous planters have visited the laboratories to consult the research officers on

problems of rubber cultivation and manufacture, and have expressed appreciation of the services rendered to them.

District Meetings.—The Organising Secretary (Mr. J. Mitchell) attended meetings of the Kegalle, Kalutara, Kelani Valley, Galle, Sabaragamuwa and Matale Planters' Associations, and gave an address on "Brown Bast and its Treatment." These meetings were very well attended and good discussions took place.

Agricultural Conference.—At the Agricultural Conference held at Peradeniya in May, Mr. J. Mitchell gave an address on "Cover Crops and Green Manuring" and Mr. T. E. H. O'Brien an address on "Some Notes on Factory Efficiency especially in reference to Crepe Manufacture." These papers and the discussions thereon were published in the local press and in the conference number of *The Tropical Agriculturist* issued in May.

PROGRESS OF WORK.

1.—ORGANISING SECRETARY.

(a) **Secretarial.**—Mr. J. Mitchell continued his duties as Organising Secretary of the Research Scheme and as Secretary of the Executive and Technical Committees. Correspondence has been heavy during the year, but has been kept up to date and the circularising of Committees and the issuing of Circulars and Bulletins has been efficiently carried out by the secretarial staff.

(b) **Visiting.**—In addition to the secretarial work, Mr. Mitchell has paid visits to 59 estates and has issued reports thereon to the Agents and Superintendents of the estates visited. Mr. Mitchell's report is attached, and it will be noted that with the exception of Brown Bast and *Oidium* leaf-fall, the general condition of estates in Ceylon continues to be satisfactory. Mr. Mitchell has paid considerable attention to the subject of Brown Bast treatment and in addition to the giving of addresses at Planters' Association meetings has carried out numerous demonstrations of the treatment. Members of the Research Scheme are urged to pay close attention to this subject as it is anticipated that with the removal of restriction the incidence of the disease will increase.

Oidium leaf-fall has been very prevalent in all districts where it occurred in 1927 and it has now appeared in other districts. The Mycologist has been instructed to pay the closest possible attention to this disease and a comprehensive series of manuring and spraying experiments has been drawn up for trial on an estate in the Matale District where the disease is severe. In Java, it has been found that spraying with Sulfinette will prevent the spread of the disease but the cost is high. Reports on the progress of the experiments will be issued periodically in order that advantage may be taken of any benefits which the experiments may indicate.

2.—CHEMIST.

Mr. T. E. H. O'Brien continued his duties as Chemist to the Scheme. His report is attached, but the following summary indicates the principal investigations he has had in hand during that period:—

(a) **Factory Efficiency.**—A comprehensive series of experiments and enquiries into the subject of efficiency of crepe rollers has been carried out and the results have been embodied in a Bulletin which will be issued in the early part of 1929. From these investigations it is concluded that:—

1. The greatest limiting factor in output is the slip which occurs when the rubber passes between the rolls. It is considered that this slip can be greatly reduced by using smooth rollers with a coarse grained texture and grooved rollers with sharp grooves.
2. Power consumption and wear and tear of machinery is greater with hard than with soft coagulum.
3. A speed of 20-22 revolutions per minute is to be recommended for both smooth and macerating rollers.
4. A gear ratio of 17:30 for the smooth rollers is to be recommended.
5. An internal water cooling system is to be recommended for blanketing crepe.
6. Plywood chests packed to full capacity are to be recommended, and each chest should hold 224 lbs. of smoked sheet or 150-160 lbs. of blanket crepe.

(b) **Curing of Sheet Rubber.**—Plans and estimates for the installation of a heating apparatus for smokehouses have been prepared, and it is hoped to carry out the experiments on a large scale during 1929.

(c) **Formic Acid as a Coagulant.**—This acid has largely replaced acetic acid as a coagulant and the results have been generally satisfactory.

(d) **Glass Hydrometers for Formic Acid.**—Supplies of these will shortly be available from Messrs. Walker Sons & Co., Ltd.

(e) **Sodium Silicofluoride as a Coagulant.**—Experiments with this coagulant have been carried out and it is considered that it would prove useful if used with a small proportion of acetic or formic acid. It is very valuable as a preventive of bubbles in sheet caused by premature clotting of latex, and it is also cheaper than acetic acid.

(f) **Mould on Smoked Sheet.**—Experiments show that it is very desirable to pack smoked sheet as soon as possible after removal from the smoke-house in order to prevent mould development.

(g) **Prevention of Spots and Mould in Crepe.**—Experiments have shown that spots and surface mould in crepe can be prevented by the use of paranitrophenol used in the proportion of 1 part paranitrophenol to 4,000 parts of dry rubber.

(h) **Samples for Imperial Institute.**—Further samples have been prepared for tests on the subject of variability of plasticity of rubber prepared under different conditions. These have been forwarded to the Imperial Institute, London, and are referred to in the report of the London Advisory Committee.

(i) **Sole Crepe.**—As sole crepe prepared by the Malayan method is regarded as superior to that prepared by the Ceylon method, a number of experiments have been carried out to determine if the former method can be adopted in Ceylon. These experiments have shown that provided crepeing machines of 24-26 inch width are available the Malayan method can be satisfactorily practised in Ceylon.

3.—PHYSIOLOGICAL BOTANIST.

Mr. R. A. Taylor returned from leave on April 2nd. and resumed his duties at the laboratory and as officer in charge of the Experiment Station, Nivitigalakele. The following summary indicates the nature of the investigations carried out by him during the year:—

(a) **Experiment Station, Nivitigalakele.**—An additional 30 acres was opened from jungle and has been terraced and planted. 15 acres of this was planted with seed at stake, three seeds being planted in each hole. The remainder has been planted with basket plants and any vacancies arising have been supplied with basket plants. In addition stumps from Heneratgoda No. 2 tree and Experiment Station Peradeniya No. 7 have been used.

The whole area has been planted with mixed cover crops and these have made satisfactory growth. It is considered that *Calopogonium mucunoides* is one of the best for producing a good cover in new clearings, closely followed by *Centrosema pubescens*. Of the more erect types *Crotalaria usaramoensis* has shown the best growth.

The main cart road to the Matugama-Agalawatte road has been completed and other roads and paths have been cut.

Owing to the poor growth of the stocks and to the use of transplanted stumps particularly in the 1926 clearing considerable difficulty has been experienced in the budding work. More recently this has been more successful and it is confidently anticipated that future results will be more satisfactory.

The following census was taken at December 31st, 1928:—

	Budded.	Sprouting.	Dormant.	% Success.
1926 Clearing	943	258	46	32.2
1927 Clearing	595	320	2	54.1
Budwood Nursery	585	585	—	100.0

Budwood is being multiplied in the budwood nurseries and the material from 50 different mother trees is now growing successfully. This will enable large quantities of budwood to be secured without the necessity of applying to the estates from which the buds were originally obtained.

There has been a slight outbreak of *Oidium* leaf disease and of Mites but no other disease in the rubber. The cover crops have been affected by the snail pest and to a less extent by *Rhizoctonia Solani* and Boga Scale.

Numerous visitors interested in budding and in contour platform planting have been to the station, and an extensive correspondence on budding and kindred subjects has been dealt with by Mr. Taylor.

(b) **Brown Bast.**—Further investigations have been carried out on this disease and a report has been submitted to the Technical Committee for its consideration.

(c) **Manuring Experiment.**—The manuring experiment on Arapolakande Estate which was commenced in April 1926 will be completed in April 1929 when a full analysis of the results will be made. Yield records have been kept and inspections have been made

throughout the year. A method has been devised for measuring indirectly the amount of foliage on the various plots under experiment and it is believed that a reliable index can be obtained of the influence of manures on the resultant foliage cover.

4.—MYCOLOGIST.

Mr. R. K. S. Murray has continued his duties as Mycologist and from the beginning of the year until April 2nd. he took charge of the Experiment Station, Nivitigalakele. His report is attached, but the following summary indicates the nature of the investigations carried out during the year:—

(a) **Root Diseases.**—A considerable amount of time has been spent on the study of the fungus *Rhizoctonia bataticola* and its relation to the fungi which have been previously recorded as being responsible for root diseases of rubber. It will be necessary to pursue these investigations further, but at the present time it is considered that while *Rhizoctonia bataticola* may attack rubber roots parasitically and possibly cause their death it does not appear to be a necessary forerunner of the fungus *Fomes lignosus*.

Observations have been carried out on various estates to determine how far cover crops such as *Dolichos Hosei* (Vigna) are responsible for the spread of root diseases and it is concluded that in affected areas such covers assist in the spread of the mycelium and the development of fructifications of *Fomes lignosus* and similar fungi, but that there is no danger from growing covercrops in unaffected areas provided such covercrops are kept under control and are not allowed to grow too closely round the base of the rubber trees.

(b) **Oidium Leaf Disease.**—During the year, an investigation into the occurrence and spread of this disease has been made, and it has been found that most estates have suffered to some extent. A questionnaire was circulated to all estates and from the replies received it would appear that the trees on slopes and exposed ridges are more severely affected than those on flat land of low elevation. It also appears that poorly-grown rubber suffers more than well grown rubber suggesting the possibility of an amelioration of the worst effects of the disease by judicious manuring. It has, therefore, been decided to carry out during 1929 a series of manuring experiments with a view to discovering some means of lessening the evil effects of the disease and also a series of spraying experiments to determine how far the attacks of the fungus can be prevented.

(c) **Bark Rot.**—Further field experiments were arranged to determine the best time and frequency to apply disinfectants to the tapped surfaces. Owing to the very low incidence of the disease during the year, no significant difference between treated and untreated trees was obtained. It will, therefore, be necessary to repeat these experiments.

(d) **Disease of Bud-shoots.**—An investigation into the dieback of shoots arising from transferred buds (budgrafts) has been carried out and a species of *Phoma* has been isolated from the diseased tissues. It has not, however, been found possible to infect bud shoots with the cultured material and it is considered that other causes may be operative.

(e) **Diseases and Pests of Vigna (Dolichos Hosei).**—A species of *Uromyces* (rust) has been found on the leaves which appears to cause a check to the growth and vigour of the cover crop. It does not, however, appear to cause the death of the *Vigna*.

Serious loss has been caused by the depredations of the Kalutara snail and most estates in the Kalutara district have suffered. Experiments have been carried out using various poisons but while some measure of success has been attained the most effective check known at the present time is to collect and destroy the snails.

RESEARCH WORK AT THE IMPERIAL INSTITUTE.

A full report on the work carried out at the Imperial Institute is attached. The London Advisory Committee has forwarded the following reports:—

- (a) Report on Causes of Variation in Plasticity (Published as Bulletin No. 49).
- (b) The Effect of New Tapping Cuts on Plasticity.
- (c) The Effect of Diluting Latex on the Plasticity of Crepe.
- (d) The Effect of Different Dilutions of Latex and Strengths of Coagulant on the Plasticity, Vulcanising and Mechanical Properties of Rubber (Published in 2nd. Quarterly Circular 1928).
- (e) Rubber from High Yielding Trees at Heneratgoda (Published in 4th. Quarterly Circular for 1928).
- (f) The Effect of Smoking Sheet with “Uncombusted” Smoke (Published in 2nd. Quarterly Circular for 1928).
- (g) The Effect on the Development of Mould of Hanging Rubber in the Factory after Smoking (Published in the 2nd. Quarterly Circular for 1928).
- (h) Standardisation of Methods of Testing (Published in the 2nd. Quarterly Circular for 1928).*

A study of the cause of variation in the plasticity of plantation rubber which was in progress during 1927 has been continued throughout the year, and a comprehensive report on 47 samples prepared in Ceylon was published as Bulletin No. 49. Work on this subject is still in progress.

A detailed study of problems in connection with compression tests on rubber is in progress and valuable assistance has been rendered by the staff of the National Physical Laboratory.

Further attention has been given to the subject of the effect of storage of rubber under temperate conditions on the plasticity of the rubber. In this connection a study is being made of rubber stored for six months under different conditions of temperature and humidity, and the results so far obtained indicate that differences in humidity may be of considerable importance.

* (i) The possibility of Latex becoming contaminated with Bordeaux Mixture as a result of Spraying Operations.

PUBLICATIONS.

Rubber Research Scheme Bulletins.—The following Research Scheme Bulletins have been issued during the year:—

No. 48.—Brown Bast and its Treatment.

No. 49.—Causes of Variation in Plasticity.

Rubber Research Scheme Quarterly Circulars.—Circulars dealing with questions of current interest to the rubber planting industry have been published at quarterly intervals. These first appear in *The Tropical Agriculturist* and are thereby made available to the whole of the subscribers to that publication and through the press to the general public. The following subjects were dealt with in these Circulars:—

1. Notes on Rubber Manufacture.
2. Mildew Disease in East Java (Reprint).
3. Report on Imperial Agricultural Conference.
4. Report on the Effect of Different Dilutions of Latex and Strengths of Coagulant on the Plasticity, Vulcanising, and Mechanical Properties of Rubber.
5. Report of the Effect on the Development of Mould of Hanging Rubber in the Factory after Smoking.
6. Report on the Effect of Smoking Sheet with "Uncombusted" Smoke.
7. Standardisation of Methods of Testing Rubber.
8. A Note on Cover Crops in Relation to Root Diseases of Rubber.
9. A Preliminary Note on a Rust on *Dolichos Hosei* (Vigna).
10. Summary of a Report on the Causes of Variation in Plasticity.
11. Note on the Renewal of Scraped Bark Surfaces.
12. Report on Rubber from High Yielding Trees at Heneratgoda.
13. Budgrafting of Rubber (Reprint).
14. The Relationship between Stock and Scion in Budded Plants (A Reply to No. 13).

Rubber Growers' Association Bulletins.—All the Bulletins published by the Rubber Growers' Association during 1928 have been received and issued to all estates which do not receive them direct from London.

MEETINGS.

The thanks of the Rubber Research Scheme are due to the Chamber of Commerce, Colombo, for the free use of their rooms for the various meetings of the Committees of the Scheme and the annual meeting.

Adopted by the Executive Committee at its meeting held in Colombo on February 22nd 1929.

RUBBER RESEARCH SCHEME (CEYLON),
PERADENIYA,
11th February, 1929.

(Signed) W. SMALL.
Acting Chairman,
Executive Committee.
Rubber Research Scheme, (Ceylon).

ORGANISING SECRETARY'S REPORT ON VISITS TO ESTATES.

—:0:—

Tours of estates situated in all the rubber growing districts have been carried out and visits have been paid to 59 estates on the list of subscribers to the Rubber Research Scheme.

The characteristic symptoms of the various diseases met with have been fully described and methods of treatment demonstrated for the benefit of the staff on each estate. These visits have been supplemented by a report for the information of the Superintendent, Agents, and Directors of the Company concerned.

The following comments indicate the conclusions arrived at as a result of these visits and represent the writer's opinion of the general condition of estates in Ceylon at the present time.

DISEASES.

1. **Root Diseases.**—As the position of *Rhizoctonia bataticola* as a possible primary factor in the causation of root diseases of rubber has not yet been definitely established it is again necessary to deal with root diseases under the well known headings.

(a). **Fomes lignosus.** There has been a further marked improvement in the condition of estates in connection with this disease and with a few exceptions it is ceasing to give the anxiety which was shown a few years ago. The writer is satisfied that if the method of treatment advised by the Rubber Research Scheme is carefully and thoroughly carried out this disease can be practically eradicated from any estate.

(b). **Fomes lamaoensis (Brown Root Disease).** This disease continues to cause the death of old trees but only in isolated units and no serious outbreak has been noted or reported.

(c). **Ustulina zonata.** This disease has been more prevalent than any other root disease and there are indications that the oldest trees are particularly liable to attack. When located at an early stage a cure can usually be effected by the treatment described in Research Scheme Quarterly Circular No. 4 of 1925 and the writer has seen some excellent work done in that connection. Tree to tree inspections should be carried out at frequent intervals in order that the early stages can be discovered. From observations made during the year the writer is of the opinion that the concrete filling method is the only one which is likely to effect a complete cure. Other methods have been tried and have proved disappointing.

(d). **Poria hypobrunnea.** This disease has not been observed on any of the estates visited nor has it been reported to the writer.

(e). **Sphaerostilbe repens.** This disease has not been observed on any of the estates visited nor has it been reported to the writer.

2. STEM DISEASES.

(a). **Stripe Canker or Bark Rot.**—There has been a marked absence of this disease in all districts visited and there is good reason to believe that the systematic preventive painting with disinfectants is a primary factor in this improved condition. It is the writer's opinion that by combining an application of 5% Brunolinum Plantarium after every tapping with an application of Cargillineum Mixture every 10 to 14 days almost complete immunity from this disease can, under the most adverse weather conditions, be secured.

(b). **Patch Canker (Claret Coloured.)**—In this connection attention is now confined to active cases located on the lower section of the trunk and the disease has practically ceased to give any anxiety to superintendents of estates.

(c). **Die-back.** No cases have been observed nor have any been reported to the writer.

(d). **Pink Disease (*Corticium salmonicolor*.)**—No cases have been observed nor have any been reported to the writer.

(e). **Brown Bast.**—This is considered to be the most serious of the diseases of rubber on Ceylon estates at the present time and instructions in diagnosis and demonstrations in treatment have been carried out on all estates visited. In addition a series of addresses on "Brown Bast and its Treatment" has been given at District Planters' Association meetings throughout the Island. As a result a considerable number of estates are now carrying out systematic treatment and it is confidently anticipated that it will very shortly become a routine operation on estates. The recovery of the bark surfaces after scraping has been very satisfactory and it is now considered that the scraping method might with advantage be practised on trees showing excessively slow bark renewal for the purpose of stimulating quicker renewal. All brown bast treatment should be carried out in fine weather as rain water has been found to have a destructive effect on the exposed tissues.

3. LEAF DISEASES.

(a). **Secondary Leaf-fall (*Phytophthora* sp.)**. The position in regard to this disease has been more satisfactory and very few estates have suffered to the extent experienced in previous years. It is now considered that the disease can be kept well under control by manuring with mixtures containing an excess of nitrogen.

(b). **Oidium Leaf-fall.** There has been a further spread of this disease and districts previously affected report a greater severity of attack. The Mycologist is now making a special study of all factors connected with the development of the disease and has arranged to carry out a series of manurial and spraying experiments during 1929. Work in Java has shown that spraying with Sulfinette is effective for the prevention of the disease but the cost is high and it will be necessary to determine if a cheaper method can be devised.

GENERAL PROBLEMS.

1. **Manufacture.** There has been no change in the methods of manufacture and reports show that the average quality of the Ceylon product has been satisfactory.

Rust on sheet has been reported from one group of estates but this is a defect now rarely met with and is one which can be easily remedied.

Mould on sheet rubber has been reported on several occasions but the use of parani-trophenol has given satisfactory results in all such cases.

Spots on crepe rubber (particularly sole crepe) have been reported but a means of preventing them has now been discovered (see Chemist's report) and it is anticipated that improvement in this connection will be effected.

2. **Budding of Rubber.** While considerable interest is being taken in this subject the general attitude of the planting community is one of caution and no large areas of budded plants have been laid down during the year.

3. **Manuring of Rubber.** Owing to the fall in the price of rubber some of the manuring programmes on estates have been curtailed. It is to be hoped that it will be possible to resume the applications at an early date as there is evidence to show that the general health of the estates was greatly improved as a result of the manuring carried out during 1926 and 1927.

4. **Cover Crops.** Most estates have continued to grow cover crops principally *Dolichos Hosei* (Vigna) but the Kalutara snail has caused considerable loss to this cover on many estates (see Mycologist's report). In the new clearings *Calopogonium mucunoides* and *Centrosema pubescens* are giving excellent results and boga medelloa (*Tephrosia candida*) is proving useful along the sides of drains and on terraces. Some estates are now utilising these covers as green manures but much more should be done in this connection.

(Signed) J. MITCHELL,
Organising Secretary.

RUBBER RESEARCH SCHEME, (CEYLON).

PERADENIYA,

11th February, 1929.

CHEMIST'S REPORT FOR 1928.

An extension to the laboratory buildings was made in the early part of the year. Considerable inconvenience was caused while building was in progress but the accommodation available for chemical work has been greatly improved. Office and store-room accommodation have also been enlarged.

The work carried out during the year is summarised in the following review.

1. FACTORY EFFICIENCY..

A.—CREPE ROLLING.

Experiments on the subject of crepe rolling were completed during the year, and the results have been embodied in a bulletin which will be issued in the early part of 1929.

The factor in crepe rolling which has been found to have the greatest influence in limiting output is the amount of slip which occurs as the rubber passes between the rolls. A comparison of the actual output obtained with that which would have been obtained if no slip occurred has been made and figures for percentage efficiency calculated for a number of machines. The efficiency of grooved macerating rollers varied from 37.7 % to 48.8 %, and that of smooth rollers varied from 19.3 % to 33.6 %.

While the efficiency of a roller depends to some extent on its mechanical condition it was concluded that (in the case of a smooth roller) efficiency depends mainly on the texture of the roller surface. A coarse grained texture which will grip the rubber is required. Hairline grooving of smooth rollers was not found to improve the efficiency to any great extent. In the case of grooved rollers the efficiency probably depends mainly on the type and sharpness of the grooves.

Other conclusions drawn from the experiments were as follows:—

- (a). The hardness of the coagulum does not influence output to any considerable extent. Soft coagulum is recommended in order to minimise power consumption and wear and tear of machinery.
- (b). Excessive speed of operation is not desirable. A speed of 20—22 revs. per minute is recommended for macerating and smooth rollers. Smooth rollers could be operated at higher speeds if designed for the purpose.
- (c). Output from a smooth roller geared 17: 30 is slightly greater than that from a roller geared 16: 20 the gain in output being approximately proportional to the increased width of the crepe from the 17: 30 machine. Crepe from a machine geared 17: 30 dries slightly more quickly and is easier to handle in the drying room.
- (d). Internal water cooling of machines used for blanketing crepe is desirable in order to minimise delays due to heating up of the rollers.
- (e). The output from 15 inch creping rollers in good mechanical condition should be approximately as follows:—

Maceration (5 rollings) 225 lbs. per hour. Smooth rolling (1 rolling)
100 lbs. per hour, Blanketing (3 rollings) 400 lbs. per hour.

B.—SHEET ROLLERS.

The output of a battery of power driven sheet rollers was measured compared with that of a Hoare's Multiple sheet roller. In both cases the output was equivalent to 300 lbs. per hour at an operating speed of 15 revolutions per minute.

C.—PACKING OF RUBBER.

In a paper read at the Peradeniya Agricultural Conference attention was drawn to the importance of economical packing of rubber especially when it is to be shipped abroad before sale. The use of plywood chests, packed to full capacity, enables a substantial saving to be made. The amount of rubber which can be packed in a chest is

Smoked sheet	...	224 lbs.
Blanket crepe	...	150—160 lbs.

D.—DURING OF SHEET RUBBER.

It was pointed out in the 1927 report that the production of heat and smoke in the smokehouse could be dealt with as separate problems and that by so doing the consumption of firewood could be cut down very substantially. The Executive Committee decided that large scale experiments in this connection should be carried out and arrangements are being made for a steam heating apparatus to be installed in an estate smokehouse.

In calculating the amount of heat which would be required for this installation, it was found that the amount of hot air which passes through an average smokehouse is sufficient to dry the rubber completely in a few hours if it gave up its moisture freely. In practice, however, rubber takes 6—10 days to dry at the usual smokehouse temperature showing how reluctantly rubber gives up its internal moisture. When the steam heating apparatus is installed it is proposed to measure the rate of airflow through the smokehouse and see how far this can be reduced without affecting the rate of drying.

It has been suggested that smokehouses should be built considerably higher than the present type in order to make better use of the smoke. The extent to which this can be done economically depends on the fall in temperature of the air as it ascends through the building. It should be possible to obtain reliable information on this and similar points in the experimental smokehouse.

During the year a portable recording thermometer has been used for obtaining an insight into temperature conditions in estate smokehouses. It was frequently observed that the correct temperature for smoking was reached only for a short period daily which means that the smokehouse was operating at a low standard of efficiency. A recording thermometer is regarded as essential if a smokehouse is to be operated at its maximum efficiency.

2.—FORMIC ACID AS A COAGULANT.

It is now more widely realized that rubber coagulated with formic acid is equal in appearance and quality to rubber prepared with acetic acid and its use in Ceylon is extending considerably. As formic acid acts rather more rapidly than acetic acid it may not be advisable to use it for sheet manufacture on estates where difficulty is experienced owing to rapid clotting of the latex after the addition of acid.

It has been stated that formic acid causes excessive corrosion of machinery and that any economy arising from its lower price is thereby lost. Formic acid is probably more corrosive than acetic acid but it should be remembered that acetic acid is also capable of causing serious damage to machinery. It is considered unlikely that corrosion will be serious in either case if machines are provided with water sprays and are thoroughly washed each day after use.

3.—GLASS HYDROMETERS FOR FORMIC ACID.

It was mentioned in the 1927 report that a glass hydrometer for testing the strength of formic acid had been developed at the Research Scheme laboratories. The first instruments submitted by the makers gave accurate readings but were large and clumsy in form. Further samples made to the dimensions and scale specified by the Research Scheme have been received recently and are considered to be satisfactory. Arrangements have been made for these hydrometers to be sold by Messrs. Walker Sons & Co., Ltd., and it is understood that supplies will be available shortly.

4.—SODIUM SILICOFLUORIDE (S. S. F.) AS COAGULANT.

The use of sodium silicofluoride as a coagulant was approved by the Rubber Growers' Association in 1925. Apparently it has not been adopted to any great extent in Malaya or Java but it is reported to be very successful for smoked sheet manufacture in Sumatra.

A few experiments were carried out by the Ceylon Rubber Research Scheme when its use was first suggested but it was thought that a coagulant used in powder form was not suited to Ceylon conditions and the investigation was not continued.

Further experiments have been carried out during the present year from which the following conclusions have been drawn :—

- (a). S. S. F. is likely to be a useful coagulant under Ceylon conditions when used in conjunction with a small proportion of acetic acid or formic acid. It can be added to the latex in the form of a suspension in water.
- (b). It has a remarkable influence in preventing the type of bubbles in sheet caused by premature clotting of the latex.
- (c). It is a considerably cheaper coagulant than acetic acid.
- (d). It cannot be used in conjunction with aluminium utensils.
- (e). Further experiments are required in Ceylon particularly with regard to the effect of S. S. F. on the colour of blanket crepe. A report from Java suggests that if S. S. F. is used the dose of sodium bisulphite can be reduced by 50 %.

5.—MOULD ON SMOKED SHEET.

An experiment was carried out for the purpose of determining the limiting moisture content at which mould develops on smoked sheet. Portions of a sheet were inoculated with mould spores and kept in atmospheres of varying moisture content. The results of the experiment were as follows:—

AMOUNT OF MOISTURE IN SHEET.

1.83 %	...	Sample covered with mould in 21 days.
0.85 %	...	Slight mould after 2 months, and a light covering after 4 months.
0.5 %	...	Slight mould on one corner of sample after 4 months.

These figures emphasise the desirability of packing smoked sheet when the moisture content is low *i.e.* as soon as possible after removal from the smokehouse.

6. -PARA NITROPHENOL (P. N. P.) FOR PREVENTION OF SPOTS AND SURFACE MOULD IN CREPE.

Two chests of blanket crepe were prepared (in January, 1928) from one batch of latex coagulated respectively with acetic acid and acetic acid containing para nitrophenol in the proportion 1 part p. n. p. to 4,000 parts dry rubber. Both samples were excellent in colour and there was no apparent difference between them. The chests were stored in the packing room at Culloden Estate and were opened and examined in December, 1928.

The rubber containing p. n. p. was satisfactory in colour and showed no sign of mould or fungal spots. The rubber without p. n. p. was badly mottled with black and pink spots and surface mould. Colombo brokers reported that this sample was typical of rubber which had been stored for a considerable period. They considered that the rubber containing p. n. p. could be sold at full market price.

The addition of the above proportion of p. n. p. to the latex can be recommended for the manufacture of blanket crepe which is likely to be stored for some time before sale or sold in a distant market. As regards rubber which will be sold within a few weeks of manufacture the position is slightly different as blanket crepe containing p. n. p. has, in some cases, a slightly yellower colour than it would otherwise have.

During the wet weather in October this year numerous complaints were received from estates of the development of spots and surface mould on crepe in the drying rooms. In some cases the mould was so pronounced that the crepe when shaken emitted clouds of dust (mould spores). When rolled to blanket the rubber was off colour and streaky. The trouble in some cases could be traced to inefficient ventilation and in others to the presence of sources of mould infection such as scrap rubber laid out on the floor of the drying shed. Where such conditions cannot be remedied immediately the addition of p. n. p. to the latex should prove an effective preventive measure. It is of interest to note that the white crepe prepared by fractional coagulation appears to be less susceptible to the growth of mould in the drying shed than ordinary crepe.

7.—SAMPLES FOR THE IMPERIAL INSTITUTE.

In connection with the investigations into the causes of variability of plasticity, samples of smoked sheet, airdried crepe, and machine dried crepe have been prepared at monthly intervals under carefully standardised conditions and forwarded to the Imperial Institute.

The number of samples forwarded during the year totalled 63 of approximately 500 lbs. weight.

8.—SOLE CREPE MANUFACTURE.

The low price of rubber stimulated interest in the possibilities of sole crepe manufacture and in the early part of the year several enquiries on the subject were received.

The usual method of sole crepe manufacture in Ceylon differs from that in other countries. In the "Ceylon method" the thin plies of rubber required for building up the sole crepe are prepared by reworking the lace crepe after drying. In the "Malayan method" this is done directly from the coagulum and the thin plies of crepe after being dried are pressed together to give the required thickness of sole crepe.

"Malayan" sole crepe is usually regarded as superior to the Ceylon product and secures a higher price. It is smoother in texture and the plies cannot be distinguished when the edge of the sheet is examined. Ceylon sole crepe rubber has a well established market for sports shoes but outside this the demand is comparatively restricted.

The writer carried out tests on the manufacture of sole crepe by the Malayan method and succeeded in preparing samples which were considered by Major Eaton (of the Rubber Research Institute of Malaya) to be up to the standard of manufacture in Malaya. It was concluded that there was nothing to prevent the adoption of the "Malayan" method of manufacture in Ceylon provided that crepeing machines of the requisite width (24—26 inch) are available.

9.—VISITS AND ADVICE TO ESTATES.

Visits were paid to 11 estates for the purpose of advising on manufacture and full reports were furnished for the information of the Superintendents and Agents.

In addition, numerous enquiries were dealt with on various subjects connected with manufacture. The number of letters received from estates and agencies on planting topics amounted to approximately 180, the time required for dealing with each varying from a few minutes to many hours.

10.—REPORTS SUBMITTED FOR PUBLICATION IN 1928.

- (a) "Notes on Rubber Manufacture" (1) Sodium silicofluoride as a Coagulant.
(2) Para nitrophenol for prevention of fungal spots in crepe.

(R. R. S. 1st. Quarterly Circular for 1928 and Tropical Agriculturist, April 1928).

- (b) "Some Notes on Factory Procedure and Efficiency, especially in reference to Crepe Manufacture."

(Paper read at the Third Agricultural Conference, Peradeniya. Tropical Agriculturist, May 1928).

- (c) "Crepe Rolling."

(To be published as R. R. S. Bulletin No. 50).

- (d) "Guide to the Preparation of Plantation Rubber in Ceylon."

(To be published as a hand book).

11.—GENERAL.

Agricultural Conference, Peradeniya.—A paper on "Some Notes on Factory Procedure and Efficiency" was read.

VISITS TO THE LABORATORIES.

During the year the Laboratories were visited by Sir Edward Rosling (Member of London Advisory Committee), Dr. A. W. Hill (Director of Kew Gardens), The Right Hon. W. Ormsby-Gore M. P. (Under-Secretary of State for the Colonies), Major B. J. Eaton (Rubber Research Institute of Malaya), the Headmaster and 28 Students from the Peradeniya Farm School, and numerous Superintendents and Assistants of Estates.

Major Eaton stayed in the District for a week and was taken to a number of estates.

BUILDINGS.

During the year the following building works were supervised:—(1) Extension to Laboratories. (2) Re-timbering roof of Mycologist's bungalow. (3) Construction of two Junior Staff bungalows.

13.—SUMMARY OF WEATHER RECORDS AT CULLODEN LABORATORIES.

	1928.	1927.
Rainfall ...	158.67 inches.	152.22 inches.
Highest monthly rainfall ...	29.03 „ (Nov.)	42.46 „ (May).
Highest daily rainfall ...	7.45 „	9.72 „
Highest shade temperature recorded (day) ...	94.5° F	93.3° F
Lowest shade temperature recorded (day) ...	76.5° F	76.8° F
Lowest shade temperature recorded (night) ...	67.7° F	66.4° F

(Signed) T. E. H O'BRIEN,

Chemist.

Rubber Research Scheme.

RESEARCH LABORATORIES,
CULLODEN ESTATE, NEBODA.

20th. January, 1929.

PHYSIOLOGICAL BOTANIST'S REPORT FOR 1928.

During the year the time has been devoted to work at the Experiment Station at Nivitigalakele, to the manuring experiment on Arapolakande Estate, to a study of brown bast disease, to a study of the problems of vegetative propagation and to an examination of high yielding trees. A short investigation of the correlation of yield with certain morphological characters of the cortex of rubber trees has also been carried out.

1. **Experiment Station.**—At Nivitigalakele 30 acres have been cleared, terraced, and planted. For the first three months this work was supervised by Mr. R. K. S. Murray by which time the jungle had been felled and burned off and the terracing had been started. Though the work was carried out as quickly as possible the available labour was insufficient to allow the terracing to be done before holing if the whole area was to be opened in one year. For this reason the usual procedure of holing after terracing was departed from over the final 10 acres. All the terracing was completed before the North-East monsoon and there was no delay in planting. 15 acres was planted with seed at stake, three seeds being allowed to each hole. The remainder was planted up with basket plants and vacancies were supplied with basket plants. The available stumps in the nursery derived from Heneratgoda No. 2 tree and Experiment Station Peradeniya No. 7 tree were also used as it has been found that seed from those trees produced vigorously growing plants. The same system of terracing as that employed on the 1926 and 1927 clearings was carried out with the exception of a portion of about 4 acres where the trench system advocated by Mr. Denham Till was adopted. This system is essentially the same as the platform system but instead of a platform a contour trench 3 ft. $\times$ 3 ft. is cut and subsequently refilled with top soil. The plants are put in after the trench has been filled up to within 6 inches of the top. During 1928 the platform system of terracing cost Rs. 90/- per acre; the trench system cost Rs. 160/- but in this case only 4 acres were trenched and the land was of a very rocky nature and not comparable to that which was terraced.

The cover crops planted late 1927 in the 1927 clearing have made excellent growth and a good cover has been established. *Calopogonium mucunoides* proved to be the best plant for producing a quick cover on the new clearings. *Centrosema pubescens* has also done well but *Dolichos Hosei* (*Vigna Oligosperma*) has shown variable results. Of the erect type of cover plants *Crotalaria usaramoensis* has grown better than any other but *Desmodium gyroides*, *Indigofera arrecta*, *Tephrosia candida* and *Clitoria cajanifolia* have all provided a good supply of loppings. *Clitoria* makes a thick hedge if planted in contour bands and should prove useful in preventing soil erosion on places where terracing is difficult. A few seeds of *Sesbania* sp. were found among one lot of seed obtained and the plants made very rapid growth. Individually the plants have a straggling growth but if planted closely together a fair quantity of mulch can be obtained. Two different species of self established *Desmodiums* are growing on the 1928 clearing and these are being encouraged.

The main cart road linking up the station with the Matugama-Agalawatte road was completed early in the year. It was found that one short portion is subject to flooding

during heavy rains and that while the flooding is very temporary in character the water flows across the road and causes this portion to be badly cut up. It is considered that the bridge and the adjoining roadway will have to be raised a further 18 inches.

Portions of two minor roads to the clearings were opened late in the year.

The results of budding in the 1926 clearing have been disappointing but in the 1927 clearing the work has been more successful. It is estimated that about 50% of the plants in the 1927 clearing are ready for budding and all these have been budded once. The average percentage of success has been 50% and of the final two clones examined 90% and 95% were shown to be successful after the second examination. It is anticipated that this standard can be maintained and that more satisfactory results will be attained during 1929. There seems little doubt that the failure of the earlier budding work was due to the poor growth of the plants in the 1926 clearing and to the use of transplanted stumps as stocks. It has been noted during the past few months that if a bud is put on at the time the stock is just beginning to put out a new whorl of leaves there is a much greater chance of success.

The following census was taken at December 31st., 1928:—

	Budded.	Sprouting.	Dormant.	% Success.
1926 Clearing	... 943	258	46	32.2
1927 Clearing	... 595	320	2	54.1
Budwood Nursery	... 585	585	—	100.0

Recently, a bark cutter has been devised for the removal of buds from the budwood. This cutter enables the operator to remove the buds without touching the cambium and when combined with the use of a suitably sized template for opening the stock a well fitting patch is ensured. This cutter has also been found very useful for the removal of buds from successfully budded plants for the rebudding of failures nearby. No wood is removed and the bark quickly recovers. The method is being employed in the 1926 clearing for rebudding clones where no further supplies of budwood are at present available.

Considerable success has been achieved in the budwood nursery and buds from 50 different mother trees are now growing there. The material produced here is to be used in the 1928 clearing and at the Paspolakande Experiment Station. Observations made during the year have shown that in a large percentage of cases suitable budwood can be obtained from unpollarded mother trees. This material is being employed where new high yielders are reported. The buds are put out in the budwood nursery and yield records are kept from that time onwards. Should the tree's yield record prove the tree to be a good one the budwood is ready at once. On the other hand it has been found that owing to the buds being too deeply set in pollarded shoots from certain trees are not suitable for budwood. Deeply set buds appear to be rare on shoots produced on young stumps hence the value of growing budwood in budwood nurseries. Another point in favour of the use of a budwood nursery is that the mother trees need not be pollarded and yield record keeping can, if desired, go on without interruption. A further advantage of a budwood nursery is that the risk of damage during transport is eliminated.

Several buds from each of five Malayan clones have been established and are growing in the budwood nursery and there is reason to believe that sufficient budwood to bud a clone from each will be available towards the end of 1929.

Of the seed obtained for use in the 1928 clearing the percentage germination obtained varied between 1% and 94% in twenty lots, the average being 55%. This takes no account of whether the seeds were put out in baskets or straight into the field.

During 1927 marcotting was successfully carried out on 77 plants. Of these, four died after removal but the rest are showing good growth. In each of these cases the stock was taken off successfully budded plants. During 1928 a bud shoot has been marcotted off the same plants and this has been successfully accomplished in most cases. Two of these have died after roots had grown through the basket of compost. By this double marcotting a series of three plants has been obtained for use in the study of the characteristics of stock and scion. This series consists of the stock and the scion and the budded plant each on its own roots.

During August a sub-committee consisting of six members of the Executive Committee of the Research Scheme visited and inspected the station. Their recommendations included a manuring programme and the planting of *Gliricidias* and *Albizzias* between alternate rows of rubber to act as shade trees and as a protection from wind. These suggestions have been adopted and *Gliricidias* are now growing in the 1926 and 1927 clearings. *Albizzia* seed has been put out in all the clearings.

A quantity of Adco synthetic farmyard manure is in course of preparation and to date one dozen stacks have been built. For this purpose weeds and cheddy are being used. Two of the stacks are ready and the material will be applied at an early date. Some of it has been used in the marcotting experiments and appears to form a suitable compost.

Apart from a little *Oidium* and occasional attacks by mites no disease or pest has appeared on the rubber. The cover crops have, however, been attacked by various pests and *Vigna* by *Rhizoctonia Solani*. Snails have caused considerable damage over a small area, eating most of the varieties of covercrop, but *Clitoria* and *Indigofera arrecta* have not been attacked. In one area *Tephrosia candida* was attacked by the Boga scale *Ceratoplastides cajani*.

During the year one gang of coolies was dismissed and another was engaged and an experienced conductor was appointed.

A considerable amount of correspondence in connection with the station has been dealt with throughout the year and all books concerned therewith have been kept up to date.

A number of planters have visited the station and have been given advice on budding and contour terracing.

2. **Mother Trees.**—A new system of recording data for each mother tree has been devised and a complete record giving details of the habit of growth, girth, locality, yield of latex and other characteristics is now possible. Particulars of all mother trees being tested at the station are now on record with the exception of a few trees from estates at a

long distance from the station. Particulars of these are being obtained and each additional high yielding tree reported is being examined as early as possible. When the indications are good a branch is taken and used as budwood in the budwood multiplication nursery. By adopting this method much time is saved and the necessity for pollarding is avoided in a large number of cases. A measurement of cortical thickness and a count of latex vessel rows has in every case been made by the method described in the circular issued during 1927.

3. **Vegetative Propagation.**—Attempts to raise rubber plants vegetatively have been made and a certain measure of success has been attained. Ordinary cuttings have not proved successful but success was obtained by a variation of the marcotting method. These experiments are now being carried out on a larger scale.

4. **Brown Bast.**—Research work on the cause of brown bast development has been continued at intervals and a report propounding a theory of a possible cause has been submitted to the Technical Committee.

5. **Manuring Experiment.**—The manuring experiment on Arapolakande Estate which will be terminated in April 1929 has been continued. Records of latex yield have been kept throughout the year and a number of inspections of the plots have been made. The yield records have not yet been analysed but measurements of the amount of foliage on the trees of each plot have been made periodically. An indirect method of measuring the density of foliage cover has been devised. A report giving full details of this method is in the course of preparation. The improvement in the foliage cover following on the application of nitrogenous manures is very clearly shown by this method. To the naked eye these plots show clearly as dark green patches with a much increased amount of shade under the trees but by the application of the method referred to it has become possible to record more accurately the results obtained from the different manures.

The following reports were submitted during the year :—

- (a). Report on the Imperial Agricultural Conference.
- (b). Report on brown bast.
- (c). Report on the relationship between stock and scion in budded plants.

During the period April 3rd. to December 31st. general correspondence amounted to 346 letters inward and 329 outward. At large proportion of these was concerned with particulars regarding mother trees and operations in the budding of rubber.

(Signed) R. A. TAYLOR,
Physiological Botanist.

RESEARCH LABORATORIES,
CULLODEN ESTATE,
NEBODA.
31ST. JANUARY, 1929.

MYCOLOGIST'S REPORT FOR 1928.

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During the year under review most of the work undertaken has been concerned with practical problems of immediate importance to the planter. The following is a summary of the work done:—

1. **Experiment Station, Nivitigalakele.**—In the absence on leave of the Physiological Botanist the experiment station was supervised during the first three months of the year and was handed over on April, 9th 1928. A full account of the progress at the station is included in the Physiological Botanist's report for 1928.

2. **Manuring Experiment on Arapolakande Estate.**—This experiment was supervised during the absence on leave of the Physiological Botanist. The annual application of manures was made in January.

3. **Root Diseases.**—An investigation into the occurrence of *Rhizoctonia bataticola* on rubber roots and its relationship to the fungi hitherto held responsible for root disease has been undertaken. A large number of diseased roots, mostly with *Fomes lignosus* as the apparent causal agent, have been carefully examined for the presence of *Rhizoctonia*, and attempts have been made to culture this fungus. Considerable difficulty has been experienced in growing the fungus from infected roots though cultures have eventually been obtained.

An examination of the entire root systems of several young rubber saplings taken from areas affected by *Fomes lignosus* tends to show that while *Rhizoctonia* may be parasitic on rubber roots ultimately causing their death, it is not a necessary precursor to an attack by *Fomes lignosus*. Three complete root systems of young plants apparently killed by *Fomes* have been examined in which neither a careful superficial search of the wood and cortex, nor a microscopic examination of sections of the small roots, nor cultural operations have provided any evidence of the presence of *Rhizoctonia bataticola*. On the other hand, *Rhizoctonia* has been found under circumstances which suggest that it is parasitic on rubber roots.

Inoculation experiments to test the pathogenicity of *Rhizoctonia bataticola* and *Fomes lignosus* on rubber roots under strictly controlled conditions have been devised. Their execution has unfortunately been delayed owing to the difficulty of obtaining suitable pots in which to grow the seedlings.

Observations made on several estates have shown that in infected areas a creeping cover plant such as *Dolichos Hosei* (Vigna) assists the spread of root fungi to a large extent. A short paper entitled "A Note on Cover Crops in relation to Root Diseases of Rubber" was published in the 3rd. Quarterly Circular of the Rubber Research Scheme.

4. **Oidium Leaf Disease.**—In order to obtain information as to the occurrence and spread of *Oidium* leaf disease in Ceylon a list of questions, accompanied by a brief description of the disease, was circulated to all estates which subscribe to the Rubber Research

Scheme. This questionnaire met with a very gratifying response, replies being received from 233 estates. A memorandum was drawn up analysing the answers received and views expressed by the various estate superintendents. The following is a brief summary of this memorandum :—

Oidium is present to a greater or less extent on most estates. Nearly all the reported cases of severe attack occur at mid and up-country elevations, and on some of these the disease is continuously active throughout the year. At higher elevations the disease is becoming more severe every year, while in the low-country, although it is becoming more widely spread, a decrease in severity as compared with 1927 is reported from many estates. The relationship between the severity of attack and weather conditions seems to be rather obscure, the answers on this point being very contradictory, but it appears probable that alternating dry and wet conditions favour the growth and spread of the fungus. Superintendents were practically unanimous in stating that hill slopes and exposed ridges are more severely attacked than flats and hollows and that rubber grown on poor soil suffers severely from the effects of the disease. Several estates reported definite benefit from nitrogeous manures.

It would appear that *Oidium* leaf-fall is on the increase, and although no evidence of decrease in yield due to the disease in Ceylon has been reported there can be little doubt that it is a potential menace to the vigour of the rubber tree and may ultimately lead to a decrease in yield per acre. The staff of the Research Scheme appreciates the necessity for studying all possible methods of control, and in addition to laboratory investigations a field experiment of a comprehensive nature has been drawn up to test (1) the value of nitrogeous manuring as a means of minimising the effects of the disease and the value of potash manuring as a possible means of increasing the resistance of the leaf to infection by the fungus, and (2) the value of spraying with Sulfinette (a lime sulphur preparation) as a direct control measure against the fungus. A site for the experiment has been selected, and it is hoped to apply the manures and carry out the spraying trials early in 1929. Arrangements have been made to continue the experiment for five years.

5. **Bark Rot.**—In order to obtain information as to the best time of application and the most suitable period between successive applications of disinfectants in the control of bark rot a field experiment was carried out from May 23rd to July 30th. Two disinfectants were used, Cargillineum Mixture B (10%) and 5% Brunolinum Plantarium in water. Unfortunately the incidence of the disease on the control blocks was so low that a comparison of the figures obtained gave no significant result.

Incidentally, it was found that no tackiness of the scrap rubber resulted when the Brunolinum was applied on to the uncoagulated scrap at the time the latex was collected. It is not possible to state whether better results in controlling the disease are obtained by applying the disinfectant at the time of collecting the scrap or at the time the latex is collected.

Figures showing the quantities and costs of the two disinfectants were carefully kept, and it was found that 1 lb. of Cargillineum Mixture was sufficient for about 400 trees at a cost of about 10 cts. per acre (100 trees) while 1 gallon of Brunolinum Plantarium solution sufficed for about 3,300 trees at a cost of about 1½ cts. per acre (100 trees.)

The experiment was repeated during the north-east monsoon but again there was so little bark rot on the control plots that no comparative results could be obtained. The figures for quantities and costs of the disinfectants closely confirmed those previously obtained.

6. Disease of Bud-Shoots.—A disease of shoots of young budded rubber is being investigated. The shoots die back starting usually at the tip and working down to the base. The affected part turns brown and finally almost black. The pycnidia of a species of *Phoma* have been found on the black portion of every diseased shoot examined, and isolations from the margin of the discoloured areas have yielded this fungus on every occasion. Pure cultures have been grown and inoculation experiments carried out on young shoots. No infection occurred whether the shoots were previously wounded or not, and it would therefore appear that the fungus is not primarily responsible for the die-back. On the other hand inoculations with pieces of diseased material gave positive results when the stem was previously wounded. This suggests that the organism causing the rotting and discolouration of the tissues is a weak parasite, and that in the field there is some predisposing cause of infection. The investigation is being continued. This disease has only been reported from one estate.

7. Rust on Vigna.—An examination of angular brown spots occurring commonly on the leaves of *Dolichos Hosei* (*Vigna*) has revealed the presence of a fungus belonging to the rusts or *Uredinales*. Two spore forms, uredospores and teleutospores, have been found the uredosori occurring abundantly on the discoloured areas on the underside of leaflets. Inoculation experiments have established the parasitism of this fungus on *Vigna* leaves and its causation of the brown spots. A study of the morphology of the fungus indicates that it belongs to the genus *Uromyces* though it has not been identified with any previously described species. The importance of this disease in the field is not yet clear. Badly attacked leaflets turn yellow and fall, but although the disease acts as a check to the vigorous growth of the cover crop no case of an area being completely killed by the fungus has yet been found.

8. Snails on Vigna.—A large number of estates have been troubled throughout the year by the attacks of the Kalutara snail (*Achatina fulica*) on *Vigna*, and there are few estates in the Kalutara district on which the cover has not been partially destroyed by this pest. The reason why *Vigna* in certain fields dies out so rapidly when attacked by large numbers of snails has not been determined, but it is probably concerned with the separate lime requirements of the snails and the *Vigna*. It has been found experimentally that *Vigna* dies as the result of the continual removal of the leaves and growing buds, but the reason for the great difficulty usually found in re-establishing *Vigna* on eaten areas is not so clear and is probably concerned with special soil conditions in such areas. In this connection the writer has noticed that where *Vigna* has been grown for some years the difficulty of re-establishment is much greater than on areas more recently planted.

For the purpose of destroying or controlling the snails a series of experiments with various poisons has been carried out. Some of these have been fairly successful but it is concluded that the most efficient and economic method of checking the activities of the snails is by collecting and killing them. On badly affected areas as many as 3,000 to 4,000 have been collected per rupee expenditure, a result with which no poison method yet tried can compare favourably. Bordeaux Mixture sprayed on the *Vigna* is a very effective barrier in checking the 'snails' progress, but its applicability appears to be confined to the isolation of newly discovered small areas.

9. **Disease Specimens.**—A large number of specimens of diseased material have been received at the laboratories. These have been carefully examined and reported on and control measures recommended where necessary. In many cases it has been necessary to visit the estates concerned.

10. **Visits to Estates.**—Visits were paid to ten estates for the purpose of advising on the treatment of diseases and full reports were supplied to the superintendents and agents.

11. **Control of Leaf Diseases.**—Correspondence has been entered into with an American firm regarding the possibility of using a fungicidal dust in the control of leaf diseases. The apparatus will require to be sufficiently powerful to project dust to the tops of rubber trees and at the same time be easily portable by coolies on rocky hill slopes. It is considered that such an apparatus might be very useful for the control of *Oidium* and *Phytophthora* leaf diseases.

12. **Reports.**—The following reports were written during 1928:—

- (1) A Note on Cover Crops in relation to root diseases of rubber, (Rubber Research Scheme 3rd. Quarterly Circular 1928).
- (2) A preliminary note on a Rust on *Dolichos Hosei* (Vigna). (Rubber Research Scheme 3rd. Quarterly Circular 1928).
- (3) Pests and Diseases of Rubber 1928, (Annual Report of the Kalutara Planters' Association).

(Signed) R. K. S. Murray,
Mycologist.

RUBBER RESEARCH SCHEME LABORATORIES,
CULLODEN ESTATE,
NEBODA.

16th. January, 1929.

REPORT OF THE LONDON ADVISORY COMMITTEE FOR 1928.

Membership of Committee.—A list of the members is given on the cover page. No alterations occurred during the year.

Sir Edward Rosling visited the Rubber Research Laboratories in Ceylon during the early part of the year and discussed various questions relating to the Scheme with the Chairman of the Executive Committee.

Meetings of the Committee.—Both the Committee and the Technical Sub-Committee held five meetings. They had the benefit of the assistance of Mr. W. Coombe and Mr. Clifford Figg (members of the Ceylon Committee) and of Mr. R. A. Taylor, Physiological Botanist, who attended meetings whilst in this country.

Finance.—The expenditure incurred by the London Committee was £ 2,572. 4s. 4d. which included £ 136. 9s. 8d. in respect of apparatus, etc., purchased on behalf of the Ceylon Committee. At 31st December 1928 there was an unexpended balance in London of £ 94. 0s. 1d.

Staff.—No alterations occurred in the technical staff which consists of Mr. G. Martin, B. Sc., A. I. C. (Superintendent), Mr. W. S. Davey, B. Sc., A. I. C., Mr. F. L. Elliott, F. I. C., and Mr. L. L. Stewart.

CO-OPERATION WITH OTHER ORGANISATIONS.

(1). **Rubber Research Institute, Malaya.**—The Committee is in full agreement with the view expressed by the Executive Committee that co-operation with the Rubber Research Institute as regards work in London is desirable. The Rubber Research Institute has suggested to the Advisory Committee which it has appointed in London that it should endeavour to effect liaison with the Ceylon Advisory Committee. In this connection it may be mentioned that Mr. P. J. Burgess has been elected Chairman of the Advisory Committee for Malaya and that Committee has been supplied at its request with a memorandum outlining the work carried out at the Imperial Institute on behalf of the Ceylon Rubber Research Scheme. Full information on this subject was also given to Major B. J. Eaton, head of the Chemical Division of the Rubber Research Institute of Malaya, and to Mr. A. S. Haynes, formerly Secretary for Agriculture, Federated Malay States, both of whom attended meetings of the Committee. Major Eaton also conferred with the technical staff on the standardisation of methods of testing and on other questions relating to rubber research.

(2). **Research Association of British Rubber Manufacturers.**—Close co-operation is maintained with this Association, which is represented on the Committee and advises on the manufacturing aspects of problems which arise in connection with the investigations of the Scheme.

Mr. Martin was appointed by the Association as one of its representatives on the Joint Committee with the British Electrical Research Association which is investigating the properties of ebonite and other insulating materials. Specimens of ebonite made from samples of raw rubber specially prepared by the technical staff in Ceylon at the request of the Committee were under investigation by the joint committees of the two Associations at the close of the year.

The investigation of Revertex in conjunction with the Association which was referred to in the appendix to the report for 1927 is still in progress.

(3). **Rubber Association of America and American Chemical Society.**—Opportunity was taken of the visit to England of Mr. R. D. Dinsmore, late Chairman of the Rubber Division, American Chemical Society, to discuss with him the best method for obtaining the opinions of American rubber and tyre manufacturers on questions relating to the quality of plantation rubber. As a result communication was established with the Rubber Association of America and with the Rubber Division of the American Chemical Society and an exchange of publications arranged.

(4). **Central Rubber Station, Java.**—The duplicate investigations of methods of testing in Java and at the Imperial Institute which have been in progress for some time were continued. As arranged with Dr. de Vries when he visited the Institute in 1927 reports on the work in progress are now exchanged every six months.

(5). **H. M. Admiralty.**—A conference was held between representatives of the Committee and of the Admiralty Cable Committee on the subject of the Admiralty dry heat test for rubber and the suitability of plantation rubber for use in Admiralty cables.

Unsmoked Sheet rubber in conjunction with paranitrophenol.—In connection with the attempts made in Ceylon to eliminate or reduce the consumption of wood fuel in the preparation of sheet rubber, further enquiries were made of the Research Association of British Rubber Manufacturers with a view to obtaining the opinion of the industry on a new form of sheet rubber prepared without smoking, but with the addition of a trace of paranitrophenol to prevent mould.

The general view of British manufacturers appears to be that the colour of the rubber is not material and that the addition of a trace of paranitrophenol is not likely to be objectionable. They suggested however that it may be necessary to take the views of dealers and brokers into consideration as if Malaya and the Dutch East Indies continue to market rubber in the usual form there may be a tendency to class any material not conforming to the accepted standard as "off colour."

At the suggestion of the Committee the Rubber Growers' Association has submitted this question to the Rubber Trade Association.

Investigations.—As in 1927 the principal problem dealt with during the year was the cause of variation in the plasticity of plantation rubber. The detailed study of the effect of differences in the method of preparation was continued and a comprehensive

report on 47 samples prepared by different methods was published in Bulletin No. 49 (see list of reports below). During the course of the investigation it became necessary to study the conditions under which extrusion tests should be carried out. Different investigators have employed different conditions in these tests and it was found that results obtained under one set of conditions did not necessarily hold for those obtained under other conditions. Work on this subject is still in progress and in the meantime the procedure at the Imperial Institute has been modified in the light of the experience gained so as to obtain results of the greatest practical value.

A detailed study has also been made of problems arising in connection with compression tests on rubber. This investigation has proved to be exceedingly complex and, at the request of the Imperial Institute, the National Physical Laboratory has kindly furnished valuable assistance on the mathematical aspects of the problems. Considerable progress has been made and the work is being continued.

In connection with the study of plasticity it is important to determine the effect of storage under temperate conditions and considerable attention has been devoted to the subject.

A comprehensive series of tests on rubber stored for 6 months under different conditions of temperature and humidity has been started and the National Physical Laboratory and the Union Cold Storage Co., Ltd. have kindly given facilities for the storage of rubber at constant temperatures. The results so far obtained indicate that differences in humidity may be of considerable importance.

The following reports on plasticity and other subjects were forwarded to Ceylon during the year:—

General Report on Causes of Variations in Plasticity—(1) keeping the coagulum in the serum for different periods before rolling; (2) passing the coagulum through the rollers for different numbers of times; (3) adding different amounts of sodium bisulphite to the latex; (4) coagulating latex of different dilutions; and (5) passing dry crepe through different types of rolls to convert it into blanket crepe (Bulletin No. 49).

The effect of new tapping cuts on plasticity.

The effect of diluting latex on the plasticity of crepe.

The effect of different dilutions of latex and strengths of coagulant on the plasticity, vulcanising and mechanical properties of rubber (2nd Quarterly Circular, 1928).

Rubber from High-yielding trees at Heneratgoda.

The possibility of Latex becoming Contaminated with Bordeaux Mixture as a result of Spraying Operations.

The effect of smoking sheet with “uncombusted” smoke (2nd Quarterly Circular 1928).

The effect on the development of mould of hanging in the factory after smoking (2nd Quarterly Circular, 1928).

Standardisation of methods of testing (2nd Quarterly Circular, 1928).

At the close of the year a report was in preparation reviewing the work carried out in recent years on the effect of organic accelerators on variability.

Further information regarding the investigations is given in the Appendix.

(Signed) P. J. BURGESS,
Chairman.

J. A. NELSON,
Secretary.
January, 1929.

APPENDIX TO ANNUAL REPORT OF THE LONDON COMMITTEE FOR 1928.

(1) **Plasticity.**—A large amount of time has been devoted to the study of plasticity of unvulcanised rubber and its relation to methods of preparation. The problems involved have proved to be exceedingly difficult owing to a variety of causes, the chief of which are (1) that the present methods of determining plasticity are only empirical; (2) that the plasticity of raw unmasticated rubber is not of such practical importance as the rate at which changes in plasticity occur during mastication; and (3) that the plasticity of rubber often changes considerably on keeping, the conditions of storage having a marked effect. So many factors require consideration that the progress of the investigation is necessarily slow.

In the course of attempts to increase the speed of testing, it was found that conclusions drawn from a comparison of samples tested under one set of conditions did not necessarily hold for tests carried out under other conditions. It became necessary therefore to study further the effect of conditions on the results of tests. The methods employed at the Imperial Institute for the routine determination of plasticity are based on those used by manufacturers for the control of factory processes (see Bulletin 47), but whereas individual manufacturers can arrange for tests to correspond with their particular factory treatment it is very desirable in investigations carried out in connection with the Rubber Research Scheme that tests should be devised which will give the same comparative results irrespective of variations in the conditions.

With this object in view, the effect of pressure on the rate of extrusion of rubber through a narrow tube was studied in detail because according to experiments conducted by Bingham of the United States Bureau of Standards on plastic materials other than rubber, the relation between rate of extrusion and pressure enables plasticity to be determined irrespective of the conditions of the experiments. Although the effect of pressure on the rate of extrusion of rubber was found to be somewhat similar to that described by Bingham for other plastic materials, absolute plasticity values could not be obtained because the rate of extrusion of rubber is not wholly dependent on plastic flow but partly on slip at the walls of the narrow tube. It has not been possible to overcome this difficulty but the matter is still under consideration.

A study was also made of the principles involved in the Ira Williams' compression test now used by a large number of manufacturers. In this test a small ball of rubber is compressed under a fixed load at a constant temperature and the rate of decrease in thickness noted. The conditions of the test have been simplified by Van Rossem and Van der Meyden by placing the ball of rubber to be compressed on a disc of definite area, and it was found at the Imperial Institute that in this case there is an exact and simple relation between the time of compression and the thickness of the compressed rubber. The relationship was also deduced from theoretical considerations and was confirmed by a more rigorous mathematical investigation of the problem by the National Physical Laboratory, undertaken at the request of the Imperial Institute.

The effect of pressure on the rate of compression has also been studied mathematically and a simple relationship deduced, but in this case the rigidity of the material is a disturbing factor in the practical tests.

Further work on these problems is in progress and in view of the promising results so far obtained it is hoped that it may be possible to devise a method of measuring plasticity in absolute values.

Although it has not been possible to obtain comparative plasticity figures which do not vary with the conditions of experiment, the present extrusion and compression tests are undoubtedly useful for rough comparisons of plasticity, especially as regards the large changes which occur during mastication.

Instead of determining the differences in plasticity between samples of rubber after mastication under fixed conditions, it was considered preferable to compare the amounts of mastication required for the samples to give a fixed result in one of the empirical tests. The results of such a test are necessarily dependent to some extent on the details of procedure, but differences between samples have a practical value. This method is accordingly now being employed until a more satisfactory basis can be devised.

This method of testing necessitated the selection of a standard plasticity after mastication. As no information was available as to the plasticity required in factory practice, five important British manufacturers were asked to supply samples of rubber masticated to their requirements and the average plasticity of these samples was adopted as the provisional standard.

As already explained the plasticity of rubber seldom remains the same on keeping and an investigation was commenced to determine the effect of storage under different temperature and humidity conditions on samples prepared by different methods.

The results of preliminary experiments on the plasticity of unmasticated raw rubber showed that smoked sheet exposed to very wet or very dry atmospheres at 60-70° F hardens considerably in six months, but the same rubber kept at 60° or 40-50° F in an atmosphere containing 60-80 per cent moisture displays little change. These results also apply to smoked sheet prepared after keeping the coagulum in the serum up to two days, and to sheet from latex containing paranitrophenol.

In addition to these investigations on the effect of different conditions of storage on the plasticity of unmasticated raw rubber, each sample received in connection with the study of the effect of methods of preparation on plasticity is now divided into two portions one of which is stored six months at 60° F in a damp atmosphere and the other at 32° F before carrying out mastication tests on the rubber. This period and these temperatures were selected to represent the conditions to which rubber may be exposed before it is used by the manufacturer.

During 1928 a number of samples which had been stored for six months at 60° F were examined and the following are the principal tentative conclusions.

(1) Crepe from very dilute latex tends to be more plastic than that from undiluted latex.

(2) The use of formic acid or sodium silicofluoride in place of acetic acid has little effect on plasticity even when an excess of these substances is used.

(3) Excessive rolling of the coagulum (more than 20 times) increases the plasticity of crepe.

(4) The longer the coagulum is kept in the serum (up to 2 days) the harder the crepe becomes.

(5) Keeping coagulum in serum up to 2 days before sheeting has little effect.

(6) Keeping coagulum from latex containing paranitrophenol up to 2 days before sheeting has little effect.

(7) The greater the amount of bisulphite added to the latex the less plastic is the crepe.

(8) The type of blanketting rolls appears to affect the plasticity of blanket crepe.

It will be seen that keeping the coagulum in the serum before crepeing causes the rubber to harden, whereas the same treatment before sheeting appears to have little effect. This is a remarkable result, confirmed by duplicate experiments, and illustrates the complexity of problems connected with plasticity. The amount of bisulphite added to latex also appears to be an important factor in connection with plasticity. It yet remains to be seen whether and how the results are affected by the period and conditions of storage and by the method of testing.

(2) **Vulcanisation tests.**—Nearly all the samples supplied for plasticity experiments were submitted to vulcanisation tests in a rubber-sulphur mixing to determine whether they were representative of the particular types of rubber. No important abnormalities were observed in these tests and it may be concluded therefore that the samples were suitable for the study of the effect of methods of preparation on plasticity.

Since the inception of systematic vulcanisation testing about 15 years ago the planters' research organisations have each used methods which although differing only in detail make the comparison of results very difficult. The Committee considers that standardisation of methods of testing would be very desirable. Preliminary discussions have been held with the rubber research staff of Java and Malaya and it is understood that it is proposed to consider a definite scheme of testing at the Conference of Rubber Investigators to be held in Java in 1929.

(3) **Organic accelerators and variability.**—A report is in preparation reviewing the work on this subject which has been in progress for some years. When complaints concerning the variability of the vulcanising properties of rubber were first made organic accelerators were not generally used, but they are now employed in most mixings. It is concluded from experiments at the Imperial Institute that their general effect is to reduce variability. There may be an appreciable amount of variation however when different samples of rubber are vulcanised in mixings containing minimum quantities of sulphur

and accelerator consistent with good mechanical properties, but there is no variation in mixings when larger quantities of these ingredients are employed. Samples of rubber several years old are liable to have inferior vulcanising properties in the presence of most organic accelerators and 5 per cent zinc oxide, but if the amount of zinc oxide in the mixing is increased considerably, satisfactory vulcanisation always occurs. This was confirmed by further work during the year.

(4) **Bordeaux Mixture.**—In continuation of previous experiments which showed that the addition of even a trace of Bordeaux mixture to latex caused the vulcanised product to perish quickly, a series of five samples was obtained for examination from an estate in Southern India while spraying operations were in progress. It was found that the spraying had not introduced sufficient copper into the latex to cause deterioration of the rubber on keeping. It cannot be too strongly emphasised, however, that in preparing rubber great care should be exercised during and after spraying operations, as the presence of even traces of copper in rubber is detrimental.

(5) **Artificial ageing tests.**—In view of the improved ageing properties conferred on a rubber-sulphur mixing by alkaline serum referred to in the last annual report, an experiment was made with various quantities of alkaline serum in a mixing containing zinc oxide and thiocarbanilide. Owing to the different mechanical properties conferred by the alkaline serum direct comparisons with control mixings were difficult, but the results indicated that the effect of the alkaline serum was similar in this mixing to that in a rubber sulphur mixing but not so marked. The advantage of using alkaline serum as a compounding ingredient could only be determined by an elaborate series of comparisons in mixings compounded to give the same physical properties soon after vulcanisation. As it was necessary to give preference to the plasticity investigations it was not possible to proceed with this work or with the continuation of the investigation on the difference between the ageing properties of fine hard Para and plantation rubber which were referred to in the report for 1927. It is hoped to find an opportunity for dealing with these outstanding problems during 1929.

Experiments have been made with the preparation of testing rings by cutting them on a lathe after vulcanisation on cylindrical moulds. So far they appear to be fairly satisfactory and should reduce considerably the time required in the preparation of the large number of test pieces used in the determination of artificial ageing properties.

(Signed) P. J. BURGESS,

Chairman.

J. A. NELSON,

Secretary.

January, 1929.

APPENDIX No. 1.

LIST OF MEMBERS.**Members of Rubber Growers' Association.**

- Aboyne-Clyde Rubber Estates of Ceylon Ltd.
 Alliance Tea Company of Ceylon, Ltd.
 Alluta Rubber and Produce Co., Ltd.
 Amalgamated Tea Estates Co., Ltd.
 Anglo-American Direct Tea Trading Co., Ltd.
 Anglo-Ceylon and General Estates Co., Ltd.
 Associated Tea Estates of Ceylon, Ltd.
 Bandarapola Ceylon Co., Ltd.
 Beau Sejour Rubber Co., Ltd.
 Beverley Tea and Rubber Estates, Ltd.
 Caledonian (Ceylon) Tea and Rubber Estates, Ltd.
 Carolina Tea Company of Ceylon, Ltd.
 Central Province Ceylon Tea Co., Ltd.
 Ceylon (Bibile) Rubber Estates, Ltd.
 Ceylon Consolidated Estates (1920); Ltd.
 Ceylon (Para) Rubber Co., Ltd.
 Ceylon Proprietary Tea Estates, Co., Ltd.
 Ceylon Planters' Rubber Syndicate, Ltd.
 Ceylon Rubber Co., Ltd.
 Ceylon Tea Plantations Co., Ltd.
 Ceylon Timber and Rubber Syndicate, Ltd.
 Colombo Commercial Co., Ltd.
 Consolidated Estates Co., Ltd.
 Consolidated Tea and Lands Co., Ltd.
 Dalkeith (Ceylon) Rubber Estates, Ltd.
 Dangan Rubber Estates, Ltd.
 Deviturai Rubber and Tea Estates, Co., Ltd.
 Dickella (Ceylon) Rubber Estates, Ltd.
 Dimbula Valley (Ceylon) Tea Co., Ltd.
 Doloswella Rubber and Tea Estates, Ltd.
 Doona Vale (Ceylon) Rubber Co., Ltd.
 Doranakande Rubber Estates, Ltd.
 Eastern Produce and Estates Co., Ltd.
 East India and Ceylon Tea Co., Ltd.
 Ederapolla Tea Co., of Ceylon Ltd.
 Elmshurst (Ceylon) Tea and Rubber Co., Ltd.
 Elston Estates Company of Ceylon, Ltd.
 Frocester Estate Rubber Co., Ltd.
 Galaha Ceylon Tea Estates and Agency Co., Ltd.
 Galphele Tea and Rubber Estates, Ltd.
 General Ceylon Rubber and Tea Estates, Ltd.
 Glen Rubber and Tea Co., Ltd.
 Glendon Rubber Co., Ltd.
 Gonagama Rubber Co., (Ceylon), Ltd.
 Govinna Rubber Co., Ltd.
 Grand Central (Ceylon) Rubber Estates, Ltd.
 Hanipha Ceylon Tea and Rubber Co., Ltd.
 Hanwella Rubber Estates, Ltd.
 Hewagam Rubber Co., Ltd.
 Higgoda Rubber Estates, Ltd.
 Honiton Rubber Co., Ltd.
 Hunasgeria Tea Co., Ltd.
 Igalkande Rubber and Tea Estates, Ltd.
 Imperial Ceylon Tea Estates, Ltd.
 Kandy Rubber and Tea Estates, Ltd.
 Kelani Valley Rubber Estates, Ltd.
 Kepitigalla Rubber Estates, Ltd.
 Kintyre Tea Estates Co., Ltd.
 Knavesmire Estates Co., Ltd.
 Kudaganga Rubber Co., of Ceylon, Ltd.
 Kurunegala Rubber Co., Ltd.
 Lanka Rubber Co., Ltd.
 Lanka Plantations Co., Ltd.
 Lavant Rubber and Tea Co., Ltd.
 Lochnagar (Ceylon) Produce Co., Ltd.
 Lowmont Estates Co., Ltd.
 Lunuva (Ceylon) Tea & Rubber Estates, Ltd.
 Mahawale Rubber and Tea Co., Ltd.
 Mapalagama Rubber Estates, Ltd.
 Mirishena (Kalutara) Rubber Co., Ltd.
 Monerakelle Rubber Estates, Ltd.
 Nagolle (Ceylon) Rubber and Tea Plantations Ltd.
 Nahalma Tea Estates Co., Ltd.
 Narangoda Rubber Co., Ltd.
 Nayabedde Estates Co., Ltd.
 Neboda (Ceylon) Rubber and Tea Estates, Ltd.
 Ouvah (Ceylon) Estates, Ltd.
 Panagula Rubber Co., Ltd.
 Panawal Tea Co., Ltd.
 Panawatte Tea and Rubber Estates, Ltd.
 Pantiya Tea and Rubber Co., Ltd.
 Parambe Rubber and Tea Co., of Ceylon, Ltd.
 Pelmadulla Rubber Co., Ltd.
 Pelmadulla Valley Tea and Rubber Co., Ltd.
 Pimbura Rubber Co., Ltd.
 Pindenioya Rubber and Tea Estates, Ltd.
 Pitakande Tea Co., of Ceylon, Ltd.
 P. P. K. (Ceylon) Rubber Estates, Ltd.
 Ragalla Tea Estates, Ltd.
 Remuna Rubber Co., Ltd.
 Rosehaugh (Ceylon) Rubber Co., Ltd.
 Rubber Estates of Bentota, Ltd.
 Rubber Estates of Ceylon, Ltd.
 Saffragam Rubber and Tea Co. of Ceylon, Ltd.
 St. George Rubber Estates, Ltd.
 Standard Tea Co., of Ceylon, Ltd.
 Sunnygama Co., Ltd.
 Telbedde (Ceylon) Estates, Ltd.
 Tempo Tea and Rubber Co., Ltd.
 United Planters' Co., of Ceylon, Ltd.
 Vogan Tea Co., of Ceylon, Ltd.
 Woodend (Kelani Valley, Ceylon) Rubber and Tea Co., Ltd.
 Yataderiya Rubber and Tea Co., Ltd.
 Yatiyantota (Ceylon) Tea Co., Ltd.

LOCAL SUBSCRIBERS.—(Companies.)

- Ambalawa Estate Co., of Ceylon, Ltd.
 Ankande Estate Co., of Ceylon, Ltd.
 Aphorpe Estates, Ltd.
 Aranayaka Rubber Co., Ltd.
 Atherfield Tea and Rubber Co., Ltd.
 Avington Tea and Rubber Co., Ltd.
 Ceylon Amalgamated Tea and Rubber Co., Ltd.
 Ceylon Land and Produce Co., Ltd.
 Clunes Estates Company of Ceylon, Ltd.
 Cocoawatte (Ceylon) Rubber and Tea Estates, Ltd.
 Colombo Commercial Co., Ltd.
 Cullen Estates, Ltd.
 Damblagolla Rubber Estates, Ltd.
 Diwala (Kegalla) Rubber Co., Ltd.
 Dorset Rubber Estate Co., Ltd.
 Eila Tea Co., Ltd.
 Estates Co., of Uva, Ltd.
 Farnham Estate Co., Ltd.
 Fernlands Tea Co., Ltd.
 Gallabodde Estate Co., of Ceylon, Ltd.
 Gallawatte (Ceylon) Rubber Co., Ltd.
 Ganapalla Estate Co., Ltd.
 Giragoda Rubber Co., Ltd.
 Golinda Tea and Rubber Co., Ltd.
 Hantane and Bollagalla Estates Co., Ltd.
 Hatbawe Rubber Co., Ltd.
 Haydella Tea and Rubber Estates, Ltd.
 Hinwerelle Rubber Co., Ltd.
 Horawala (Kalutara) Rubber Co., Ltd.
 Hulundawa Rubber and Tea Co., (Ceylon)
 Hunuwella (Pelmadulla) Rubber Co., Ltd.
 Jambulande Tea and Rubber Estates, Ltd.
 Kaluganga Valley Tea & Rubber Co., Ltd.
 Kalutara Co., Ltd.
 Kalutara Rubber Co., of Ceylon, Ltd.
 Kanana Rubber Estate Co., Ltd.
 Kandy Hills Co., Ltd.
 Karandupona Estates Co., Ltd.
 Katiapola Rubber Co., Ltd.
 Kelani Tea Garden Co., Ltd.
 Kelani Valley Rubber Co., of Ceylon, Ltd.
 Kinnersley (Kalutara) Rubber Co., Ltd.
 Kiriella Estate Co., Ltd.
 Kuttapitiya Tea and Rubber Co., Ltd.
 Lagos (Ceylon) Rubber Co., Ltd.
 Lansdowne Rubber Co., Ltd.
 Lassahena Rubber Co., Ltd.
 L. L. P. Estates, Ltd.
 Lipton, Ltd.
 Lunugala Tea and Rubber Co., Ltd.
 Lyegrove Rubber Co., Ltd.
 Macaldeniya Tea and Rubber Co., Ltd.
 Mahagama Rubber Co., Ltd.
 Meall Mor (Ceylon) Estates, Ltd.
 Mocha Tea Co., of Ceylon, Ltd.
 Moneragalla Rubber Co., Ltd.
 Morakelle Rubber Co., Ltd.
 Neuchatel Estates, Ltd.
 Niriwatte Co., Ltd.
 North Western Rubber Co., Ltd.
 Opalgalla Tea and Rubber Estates, Ltd.
 Opata Tea and Rubber Co., Ltd.
 Panana (Kegalla) Rubber Co., Ltd.
 Peacock and Nilambe (Ceylon) Tea and Rubber Estates, Ltd.
 Piccadilly (Kelani Valley, Ceylon) Rubber and Tea Estates, Ltd.
 Pine Hill Estates Co., Ltd.
 Poonagalla Valley, (Ceylon) Co., Ltd.
 Ragama Tea and Rubber Co., Ltd.
 Ratwatte Cocoa Co., Ltd.
 Rayigam Co., Ltd.
 Ruanwella Tea Co., Ltd.
 Rubber Plantations, of Kalutara, Ltd.
 Ryan Estates, (of Ceylon,) Ltd.
 Sheldon Estates, Ltd.
 Sitawaka Tea and Rubber Co., Ltd.
 Sunderland (Ceylon) Rubber Co., Ltd.
 Syston Estates Co., of Ceylon, Ltd.
 Tannahena Rubber Estates, Ltd.
 Tillyfour Rubber Co., Ltd.
 Udabage Tea and Rubber Co., Ltd.
 Udagoda Tea and Rubber Co., Ltd.
 Udakelle Rubber Co., Ltd.
 Udapolla Rubber Co., Ltd.
 Ullswater Rubber Co., of Ceylon, Ltd.
 Usk Valley (Kalutara) Rubber Co., Ltd.
 Uva Rubber Co., of Ceylon, Ltd.
 Vauxhall Rubber Co., Ltd.
 Vincit Tea and Rubber Co., Ltd.
 Walakande Rubber Co., Ltd.
 Walker, Sons, & Co., Ltd.
 Warriapolla Estates Co., Ltd.
 Watapota Rubber and Tea Estates, Ltd.
 Wellandura Tea and Rubber Co., Ltd.
 Weniwella Rubber Co., Ltd.

LOCAL SUBSCRIBERS (INDIVIDUALS.)

E. G. Adamaly & Co.,	...	Alavi Estate.
Messrs. D. S. Caméron & G. B. Foote	...	Bere Ferrers Estate.
C. M. Dias, Esq.,	...	Gurudola Estate.
C. E. A. Dias, Esq.,	...	Mukalana and Wawulugala Estates.
The Rt. Hon. Lord Elphinstone,	...	Gikiyanakande Estate.
The Hon. Sir H. Marcus Fernando,	...	Nottingham Estate.
The Hon. Mr. C. H. Z. Fernando,	...	Awliscombe & Batakande Estates.
E. C. de Fonseka, Esq., M.B.E.,	...	Silverdale Estate.
C. F. Hutchinson, Esq.,	...	Mapitigama Estate.
Sir H. M. Mallaby-Deely, Bart.,	...	Ambanpitiya Estate.
Mackwoods, Ltd.,	...	Guava Hill Estate.
Mackwoods, Ltd.,	...	*Cottagalla, Hylton, & Imboolpitiya Estates.
Mrs. A. S. Orchard,	...	Ilwana Estate.
Messrs. Wilmot A. and Leslie R. Perera,	...	Hegalla Estate.
S. F. H. Perera, Esq.,	...	Walahanduwa Estate.
Lambert L. Pieris, Esq.,	...	Bibilioyatenne Estate.
The Hon. Mr. D. S. Senanayake	...	Narangoda Estate.
N. D. S. Silva, Esq.,	...	Silvaland Estate.
L. W. A. de Soysa, Esq.,	...	Paradise and Nugahena Estates.
R. E. S. de Soysa, Esq.,	...	Nella Olla Estate.
John H. Starey, Esq.,	...	Tudugalla Estate.
A. Sykes, Esq.,	...	Duhallow Estate.

*New Estate for 1929.

APPENDIX No. II.**BULLETINS.**

- No. 1. The Effect of Tapping on the Movements of Plant-Food in *Hevea brasiliensis*.
 „ 2. The Effect of Tapping on the Movements of Plant-Food in *Hevea brasiliensis* (continued).
 „ 3. Seasonal Variations in the Movements of Plant-Food in *Hevea brasiliensis*, Part I
 „ 4. The Physiological Effects of Various Tapping Systems, Part I.
 „ 5. Progress Report on Vulcanization Tests.
 „ 6. The Physiological Effects of Various Tapping Systems, Part II.
 „ 7. The Physiological Effects of Various Tapping Systems, Part III.
 „ 8. Seasonal Variations in the Movements of Plant-Food in *Hevea brasiliensis*, Part II.
 „ 9. Vulcanization Tests.
 „ 10. Vulcanization Tests.
 „ 11. Variability in Rubber Manufacture.
 „ 12. Progress Report of the Rubber Research Chemist.
 „ 13. Vulcanization Tests.
 „ 14. On the Variation in the Number of Latex Vessels present in *Hevea brasiliensis*.
 „ 15. Vulcanization Tests.
 „ 16. On the Natural Clotting of Rubber Latex.
 „ 17. Vulcanization Tests.
 „ 18. Measurements of "Bark Renewal."
 „ 19. Vulcanization Tests.
 „ 20. Vulcanization Tests.
 „ 21. Vulcanization Tests.
 „ 22. Vulcanization Tests.
 „ 23. Vulcanization Tests.
 „ 24. Vulcanization Tests.
 „ 25. Vulcanization Tests.
 „ 26. Results of the Trials of Ceylon Rubber for the Manufacture of Ebonite.
 „ 27. Vulcanization Tests.

- No. 28. Vulcanization Tests.
 „ 29. Summary of Results of Vulcanization Tests.
 „ 30. The Penetration of Disinfectants on the Tapping Cut of Hevea.
 „ 31. On the Occurrence of Rust on Sheet Rubber.
 „ 32. On the “ Preservation of Latex.”
 „ 33. Variability of Plantation Rubber, 1st Interim Report (New Series).
 „ 34. Variability of Plantation Rubber, 2nd Interim Report (New Series).
 „ 35. Variability of Plantation Rubber, 3rd Interim Report (New Series).
 „ 36. Variability of Plantation Rubber, 4th Interim Report (New Series).
 „ 37. Variability of Plantation Rubber, 5th Interim Report (New Series).
 „ 38. Variability of Plantation Rubber, 6th Interim Report (New Series).
 „ 39. Variability of Plantation Rubber, Final Report (New Series).
 „ 40. Vulcanizing and Mechanical Properties of Wet Rubber.
 „ 41. First Interim Report on Artificial Ageing Tests on Plantation Rubber.
 „ 42. On the Smoking of Sheet Rubber in Relation to Mould Prevention.
 „ 43. The Inter-relationship of Yield and the various Vegetative Characters in Hevea brasiliensis.
 „ 44. The Construction of Smoke-houses for Small Rubber Estates.
 „ 45. The Efficiency of Disinfectants and Fungicides.
 „ 46. The Control of Bark Rot by Disinfectants.
 „ 47. On the Variability of Ceylon Estate Grades.
 „ 48. Brown Bast and its Treatment.
 „ 49. Causes of Variation in Plasticity.

APPENDIX No. 11—*Contd.***CIRCULARS.**

No.	No.
1. Research Work in Ceylon (17-2-21).	15. Third Quarterly Circular for 1925.
2. Budding and Grafting of Rubber (2-9-21).	16. Fourth Quarterly Circular for 1925.
3. Research Work in Ceylon (5-9-21)	17. First Quarterly Circular for 1926.
4. Scale of Subscriptions (27-2-22)	18. Second Quarterly Circular for 1926.
5. Research Work in Ceylon (1-7-22)	19. Third Quarterly Circular for 1926.
6. Rust and Mould on Sheet Rubber.	20. Fourth Quarterly Circular for 1926.
7. Research Work in Ceylon.	21. First Quarterly Circular for 1927.
8. Shipment of Latex.	22. Second Quarterly Circular for 1927.
9. First Quarterly Circular for 1924.	23. Third Quarterly Circular for 1927.
10. Second Quarterly Circular for 1924.	24. Fourth Quarterly Circular for 1927.
11. Third Quarterly Circular for 1924.	25. First Quarterly Circular for 1928.
12. Fourth Quarterly Circular for 1924.	26. Second Quarterly Circular for 1928.
13. First Quarterly Circular for 1925.	27. Third Quarterly Circular for 1928.
14. Second Quarterly Circular for 1925.	28. Fourth Quarterly Circular for 1928.

APPENDIX No. III.

SCALE OF ANNUAL SUBSCRIPTIONS.

				£.	s.	d.
No Output ...	...	...	...	10	10	0
Output up to and not exceeding	100,000 lbs.	...	...	15	15	0
Exceeding 100,000 lbs. not exceeding	200,000	...	...	21	0	0
Do 200,000 „ do	300,000	...	...	26	5	0
Do 300,000 „ do	400,000	...	...	31	10	0
Do 400,000 „ do	500,000	...	...	36	15	0
Do 500,000 „ do	600,000	...	...	42	0	0
Do 600,000 „ do	700,000	...	...	47	5	0
Do 700,000 „ do	—	...	...	52	10	0

For conversion purposes the rate of exchange is the Bank's selling rate for Demand Drafts on London on 15th January or July respectively.

RUBBER RESEARCH SCHEME (Ceylon).
ESTIMATES OF INCOME AND EXPENDITURE
FOR 1929.

REVENUE STATEMENT.**CEYLON.**

			Rs.	c.	Rs.	c.
Balance at December 31st, 1928	...	...	82,745	66		
Less Sundry creditors (approximate)	...	...	2,500	00		
					80,245	66
Income for 1929.						
Government grant for 1929	...	...	67,500	00		
Local subscriptions 1929	...	...	33,000	00		
Interest on deposit and current accounts	...	...	2,400	00		
Rent of Culloden bungalows	...	...	1,800	00		
					104,700	00
			TOTAL	Rs.	184,945	66

LONDON.

				£.	s.	d.
Balance at December 31st, 1928	...	...	...	94	0	1
Income for 1929.						
Contribution from Rubber Growers' Association	...	...	...	2,000	0	0
Remittance from Ceylon committee	...	...	...	650	0	0
Interest on balances	...	...	...	30	0	0
				£	2,774	0 1

EXPENDITURE STATEMENT.

CEYLON.				Rs.	c.	Rs.	c.
1. Personal Emoluments.							
(a)	Salaries and wages	...	...	63,636	00		
(b)	House allowances	...	...	1,519	00		
						65,155	00
2. Laboratory.							
(a)	Chemicals and laboratory upkeep	...	...	2,000	00		
(b)	Samples for Imperial Institute	...	...	250	00		
(c)	Manuring experiments	...	...	500	00		
(d)	Spraying experiments	...	...	300	00		
(e)	Apparatus from London	...	...	2,000	00		
						5,050	00
3. Buildings.							
(a)	Repairs	...	...	1,500	00		
(b)	Insurances	...	...	316	00		
(c)	Water supplies	...	...	350	00		
						2,166	00
4. Office.							
(a)	Printing, Stationery, Advertising	...	...	2,000	00		
(b)	Furniture	...	...	200	00		
(c)	Books and periodicals	...	...	200	00		
(d)	New typewriter	...	...	450	00		
						2,850	00
5. Travelling.							
(a)	Upkeep of motor car	...	...	3,000	00		
(b)	Insurance of car	...	...	130	00		
(c)	Subsistence allowances and travelling of all officers	...	...	4,500	00		
(d)	Passages from England	...	...	1,600	00		
						9,230	00
6. Incidentals.							
(a)	Postages and telegrams	...	...	1,200	00		
(b)	General charges	...	...	500	00		
(c)	Audit and accountancy	...	...	300	00		
						2,000	00
7. Sinking fund for bonuses and passages						10,000	00
8. Upkeep of roads						700	00
9. Special Charges.							
(a)	Visit of Mr. Martin to Ceylon and Java	...	...	5,000	00		
(b)	English baths	...	...	300	00		
(c)	London expenditure	...	...	9,450	00		
						14,750	00
10. Experiment Station.							
(a)	Development and upkeep	...	...	12,738	00		
(b)	Upkeep of road	...	...	500	00		
						13,238	00
TOTAL						Rs. 125,139	00

EXPENDITURE STATEMENT.—Contd.**Summary for Ceylon.**

			Rs.	c.
Balance at December 31st, 1928.	...	...	80,245	66
Estimated receipts during 1929.	...	...	104,700	00
			184,945	66
Estimated expenditure during 1929.	...	...	125,139	00
Estimated balance at December 31st, 1929.			Rs. 59,806	66

LONDON.

			£	s.	d.
1. Salaries and wages	...	...	2,188	0	0
2. Postages, telegrams, and stationery.	...	...	50	0	0
3. Gas and electricity.	...	...	120	0	0
4. Apparatus and chemicals.	...	...	125	0	0
5. General charges.	...	...	50	0	0
			TOTAL £	2,533	0 0

Summary for London.

			£.	s.	d.
Balance at December 31st, 1928.	...	...	94	0	1
Estimated receipts during 1929.	...	...	2,680	0	0
			2,774	0	1
Estimated expenditure during 1929	...	...	2,533	0	0
Estimated balance at December 31st, 1929.			£. 241	0	1

SINKING FUND FOR BONUSES AND PASSAGES.

			Rs.	c.
Fund at December 31st, 1928.	...	...	17,850	00
Payment to fund during 1929.	...	...	10,000	00
Estimated interest during 1929	...	...	990	00
			TOTAL Rs.	28,840 00

Disbursements from Fund during 1929.

Bonus to Mr. J. Mitchell.	...	8,400	00
Passage to England for Mr. J. Mitchell		700	00
		9,100	00
Estimated balance at December 31st, 1929.		Rs. 19,740	00

These estimates were considered and approved at the meeting of the Executive Committee held on December, 21st, 1928.

By Order,
(Signed) J. MITCHELL,
Organising Secretary.

RUBBER RESEARCH SCHEME, (CEYLON),
PERADENIYA.
19th, March, 1929.

